8.0 Challenges and Emerging Issues for CPS

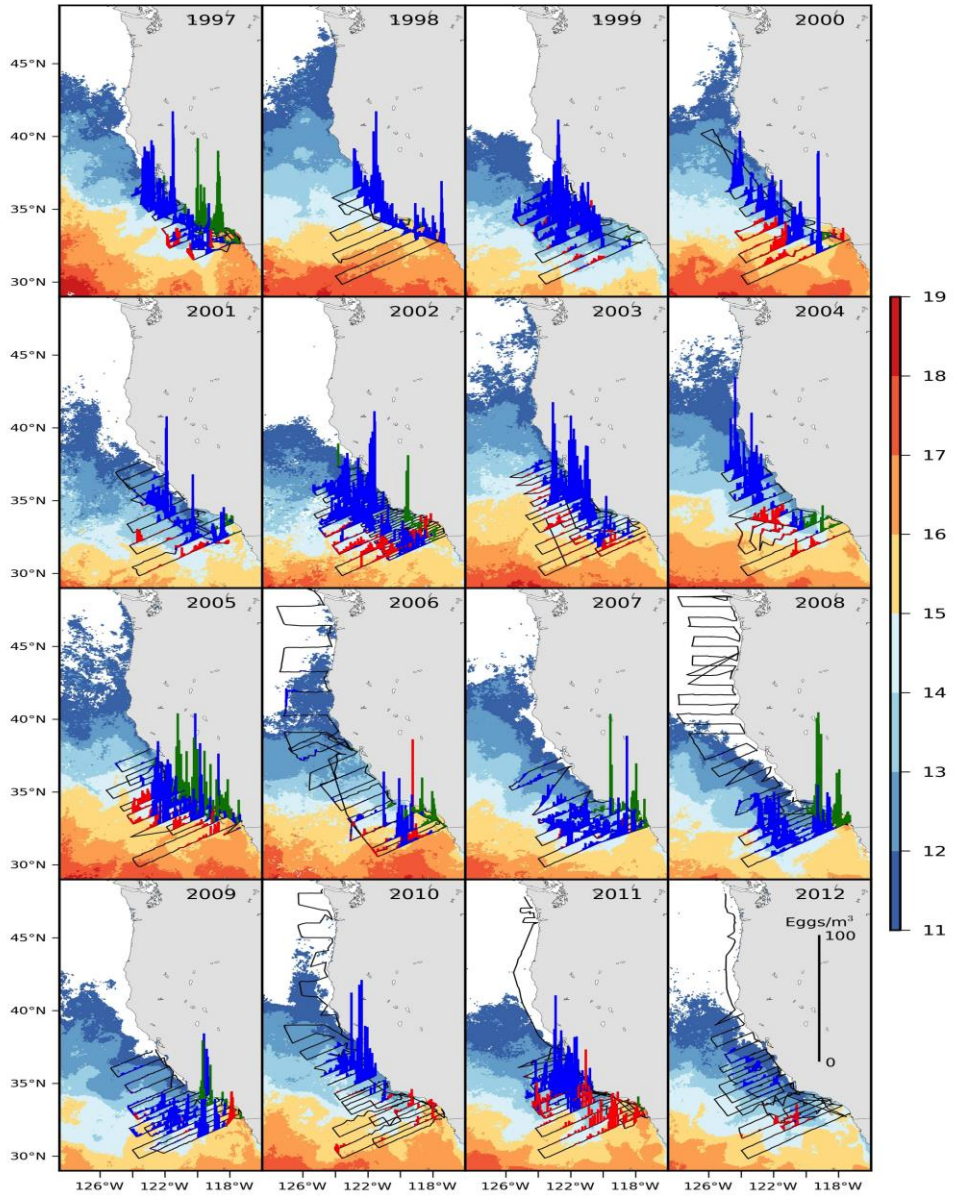
1. Methods:
A. Better Characterization of Acoustic Backscatter: Tech Tank
B. Better Characterization of Trawl Performance: video and acoustics
C. Better Characterization of Life History Characteristics for DEPM: Aquarium
D. Stock Structure and Migration: Tagging, Genetics, Otoliths:
E. Methods for Studying Recruitment and YOY.

2. Survey Designs:
A. Continued Refinement of CalCOFI and Spring Survey
B. Continued Refinement of a Coastwide Multi-species Summer Survey
C. Surveys for Recruits
D. Standard Methods for Two Ship surveys:

3. Diversifying the CPS portfolio:
A. Improved Monitoring and Management of Market Squid:
B. Tri-national Monitoring (and perhaps management) Framework
C. Meaningful Forage Measures and Products

4. Continue to Improve Data Management and Staffing based on CalCOFI Framework

8.0 Challenges and Emerging Issues for CPS



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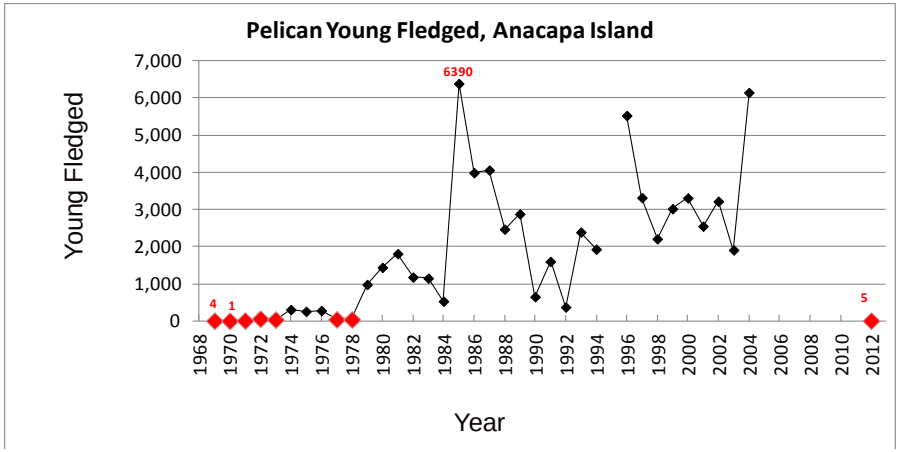
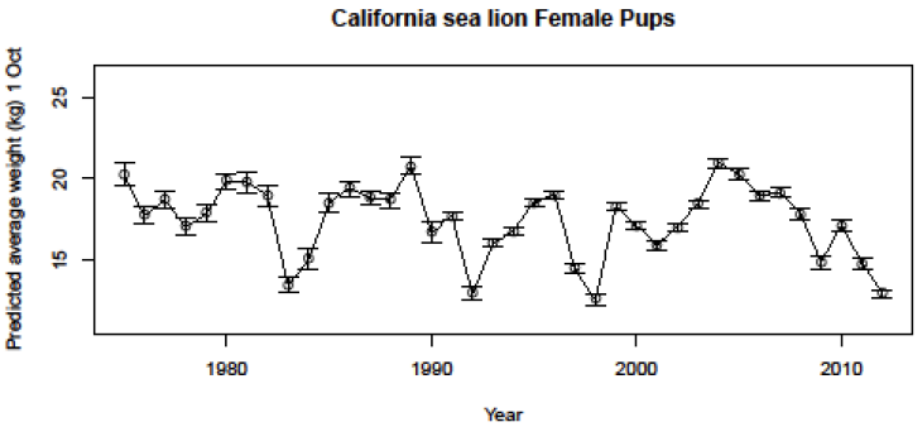
Forage: the Final Frontier





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Background on Underway Sampling Approaches:
In Binder but Not to be Projected

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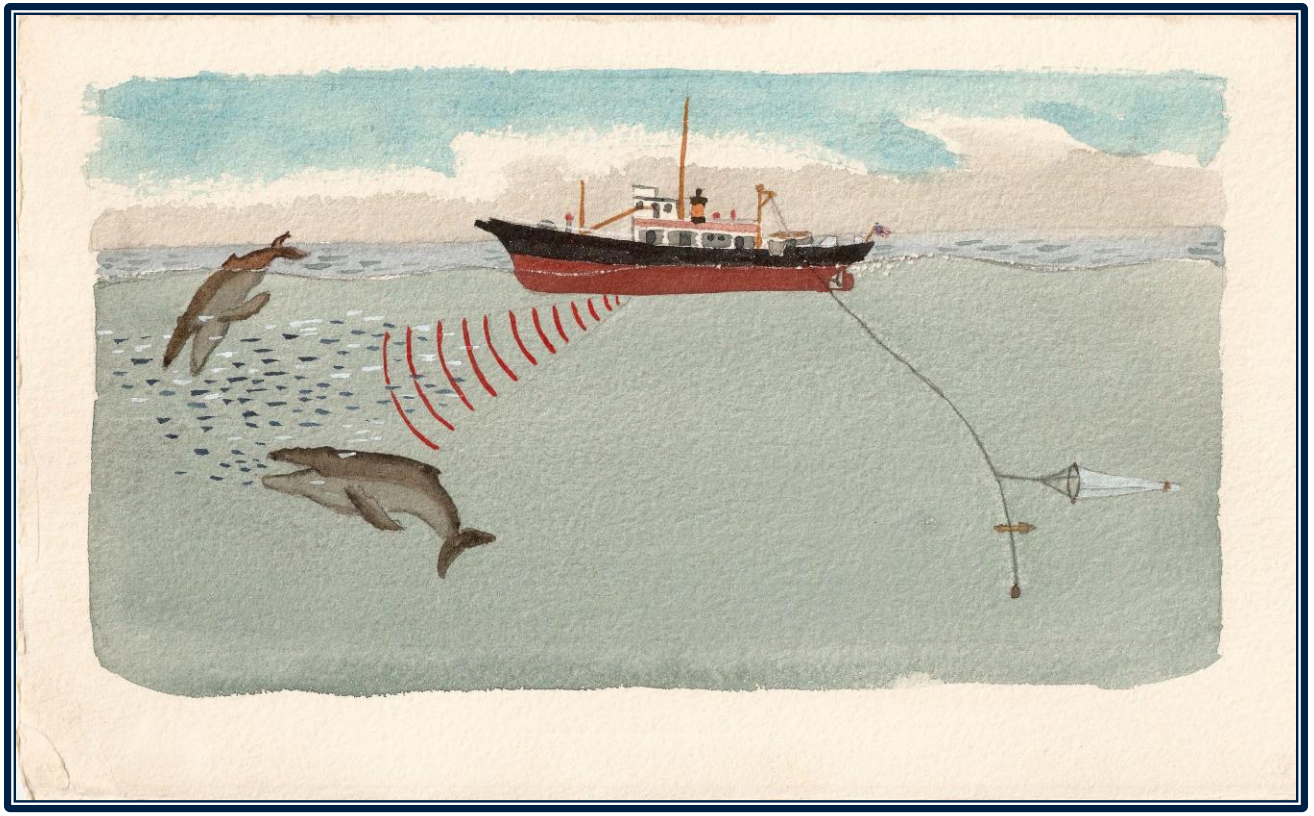
The Ecosystem Vision



“investigate the sardine in relation to its physical and chemical environment, its food supply, its predators and its competitors” ***California Cooperative Oceanic Fisheries Investigations, technical committee 1947***

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The Challenge

Making the most of the new FSV's to realize the Ecosystem Vision and MSRA mandates for ACLs and EFMP's:

The Role of Underway Sampling

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The Premise:

Integrated, Multi-Trophic, Biological and Physical Observations achieve efficiencies, but also produce better Ecosystem Observations.

New Ship Opportunities:

1. underway physical measurements (carbon and OA)
2. underway automated biological sampling
3. underway automated optical sampling
4. acoustic approaches to habitat and biology
5. high band width "virtual seagoing scientists" for outreach as well as science

New Laboratory R&D Opportunities:

1. Genomics and Climate Change
2. Test Tank and Improved Optical Methods
3. Test Tank and Improved Acoustic Methods

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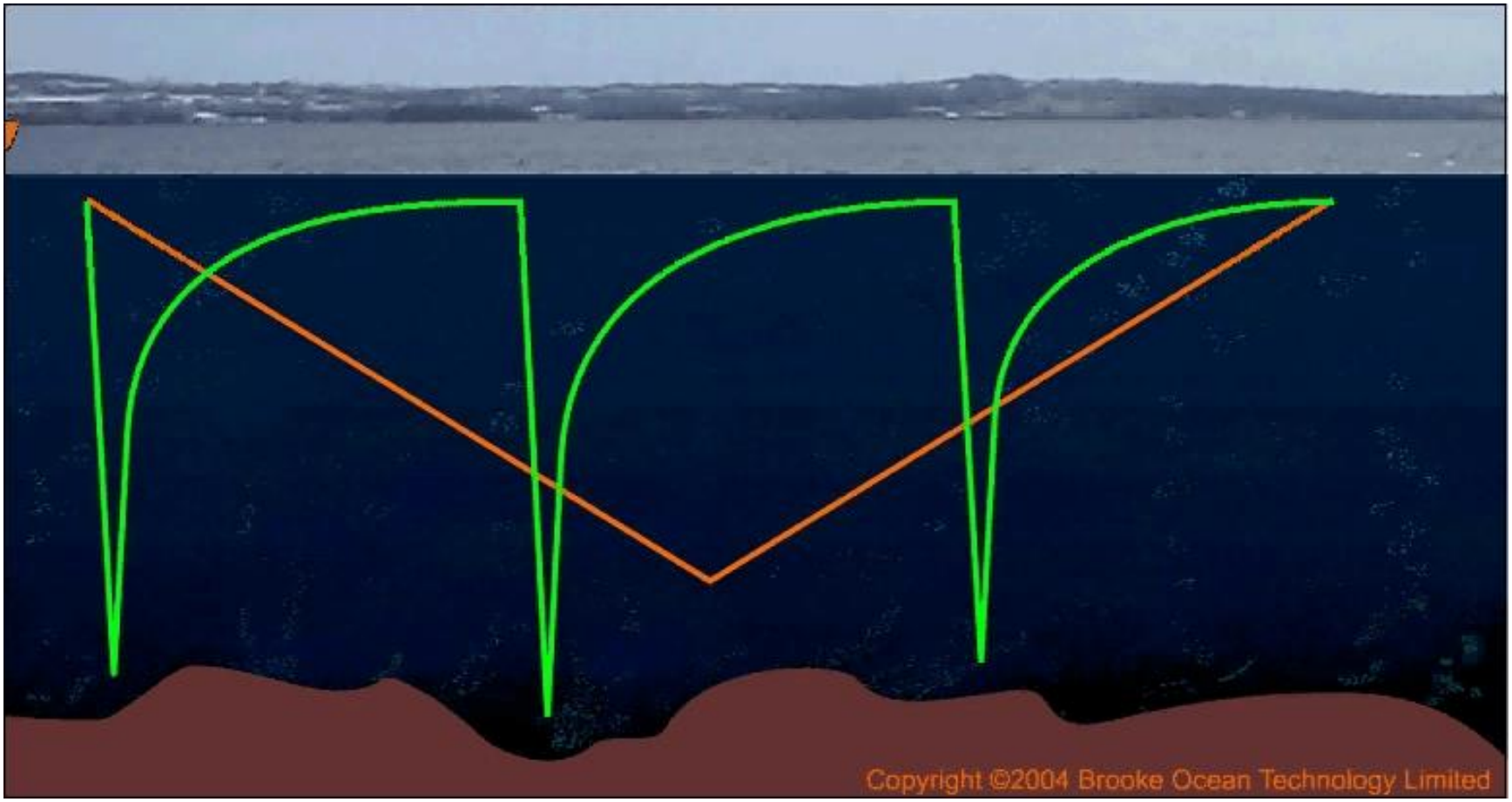
Underway Physical Sampling



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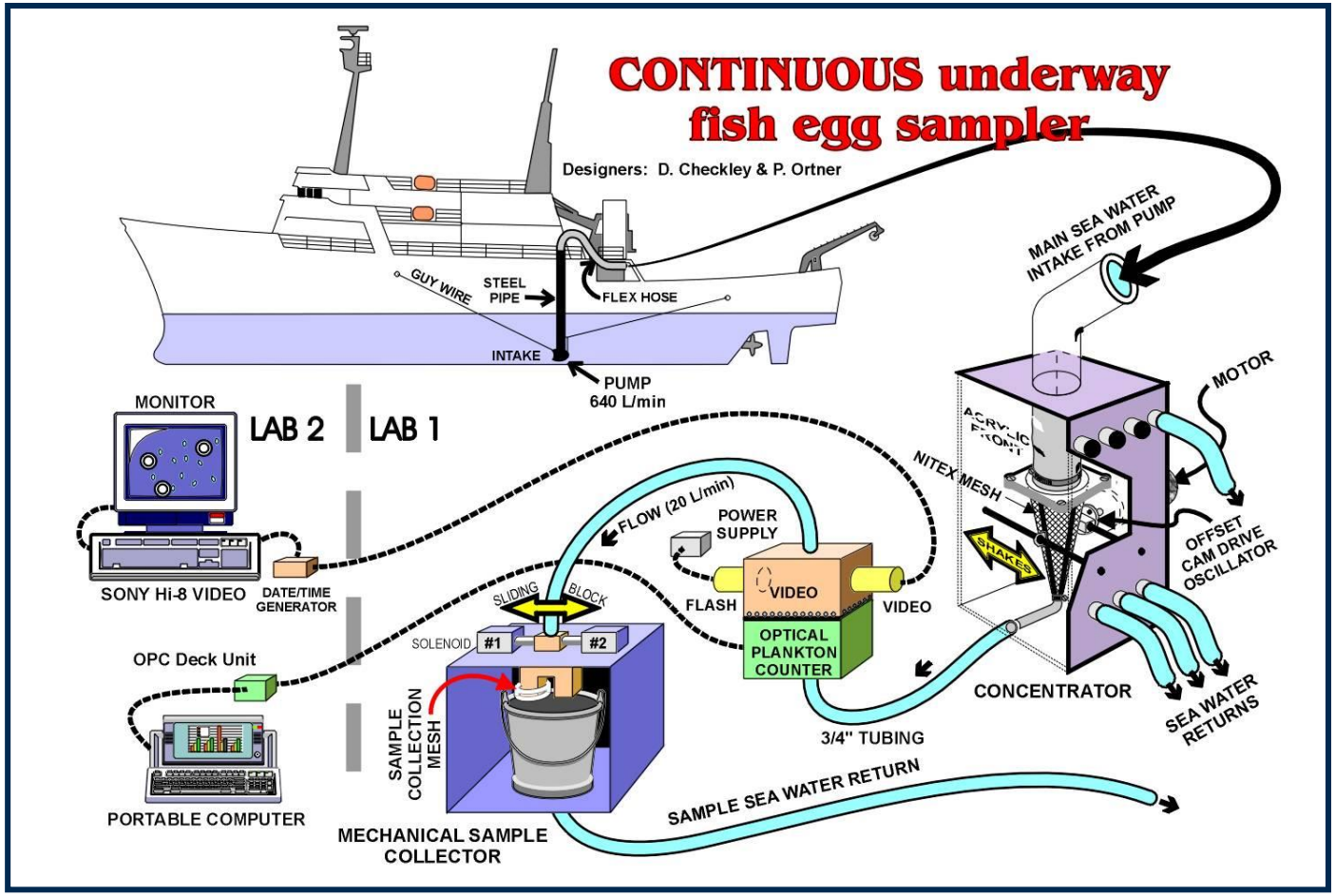
Underway Biological Sampling



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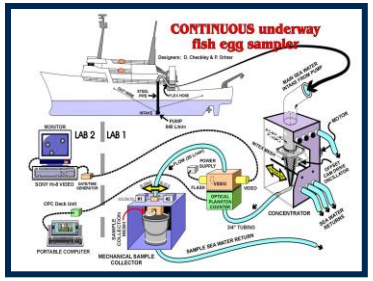
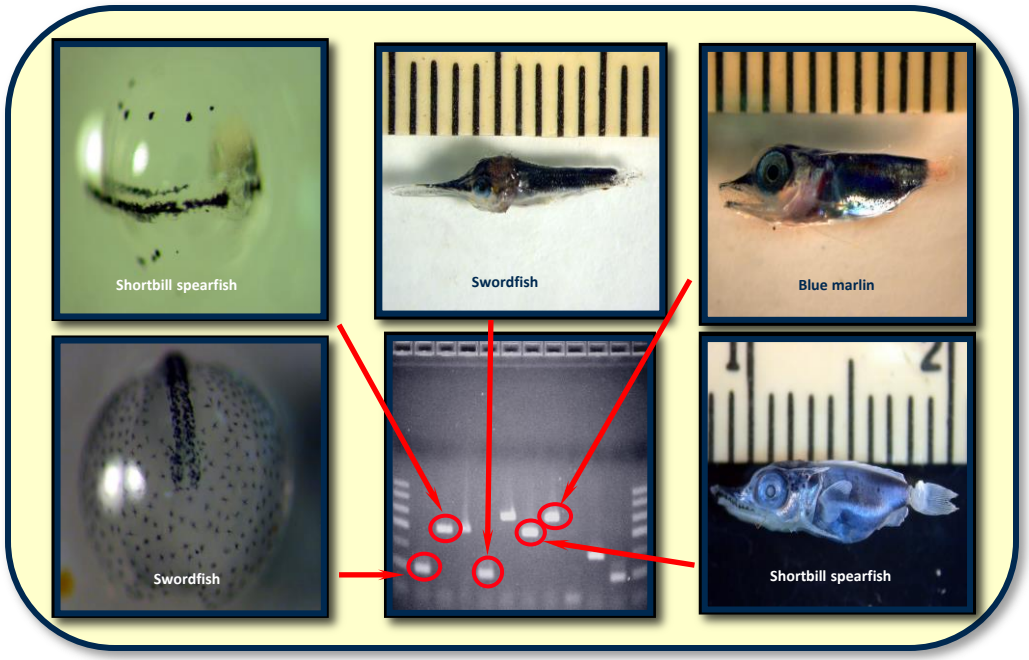
Underway Molecular Egg ID and Adaptive Sampling (Fish and Chips)





DNA-specific probes and optical detection identify larvae and egg samples.

Collaborators

Pacific Islands Fisheries Science Center, Scripps Institution of Oceanography, Census of Marine Life (Barcode of Life Initiative)

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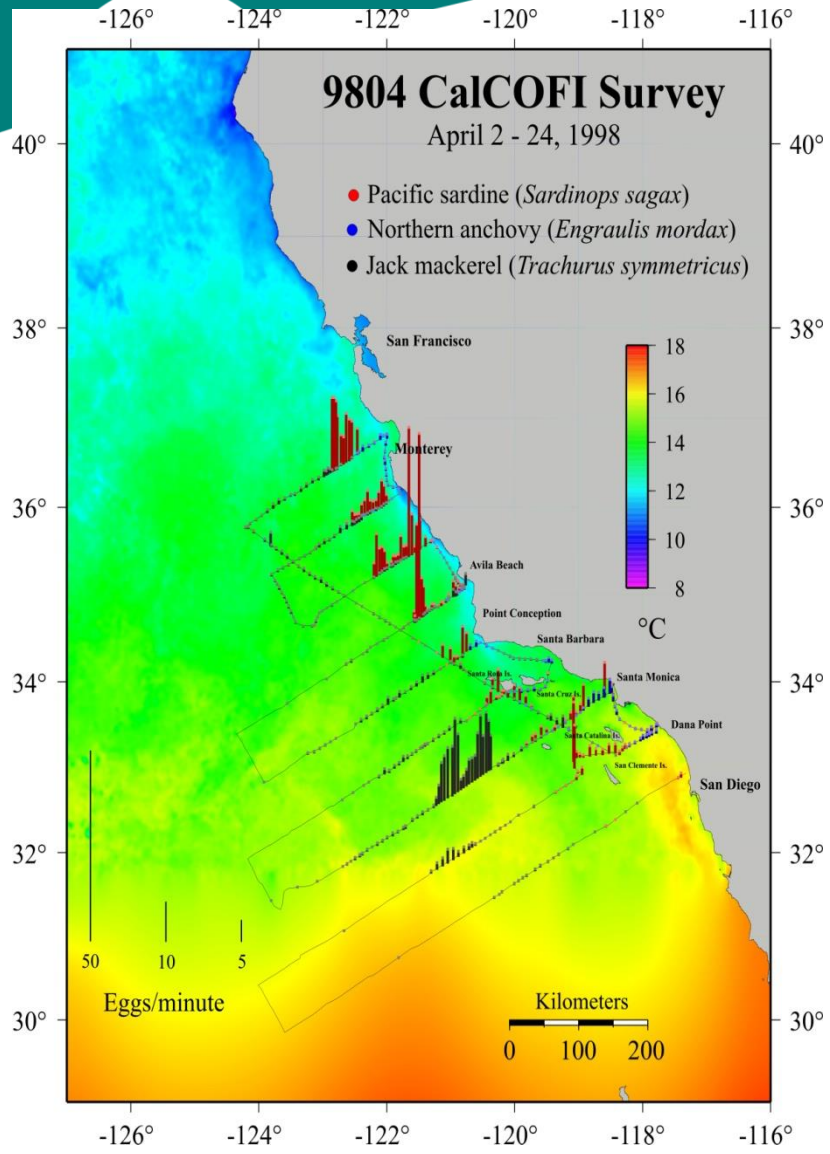
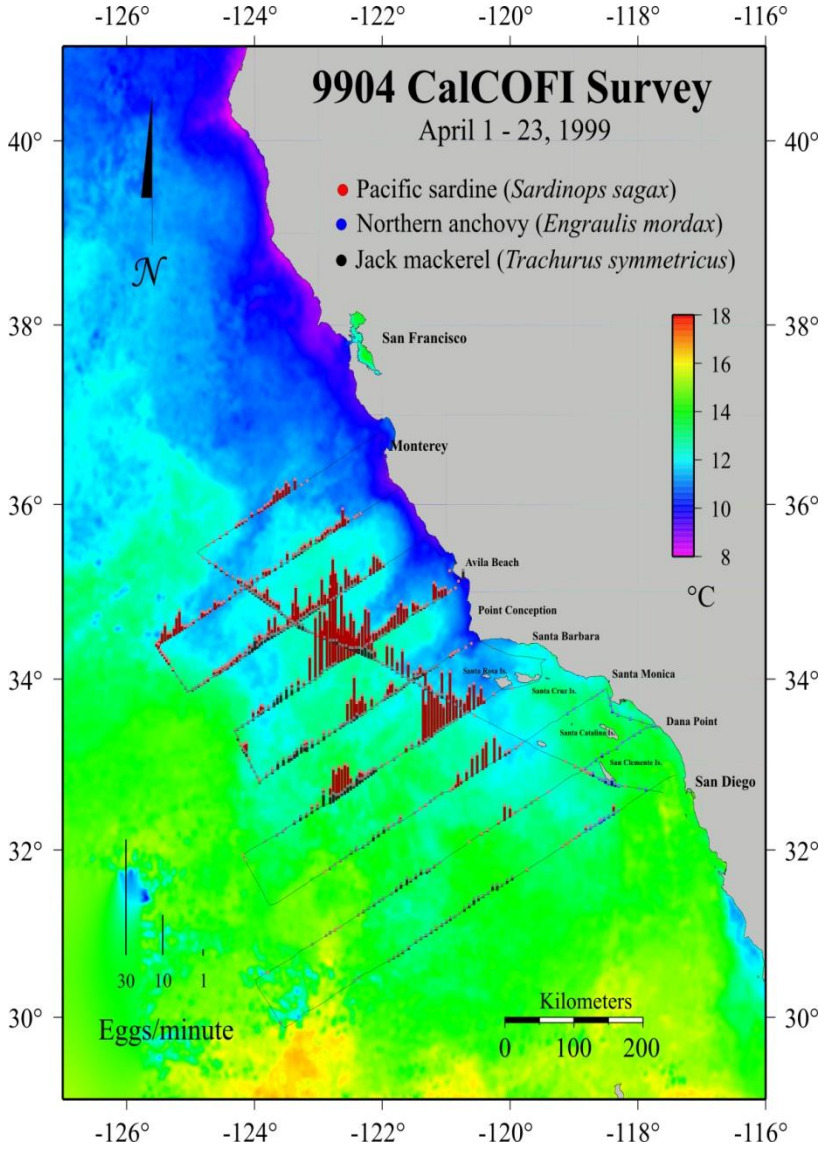
CUFES: new insights from continuous coverage vs stations





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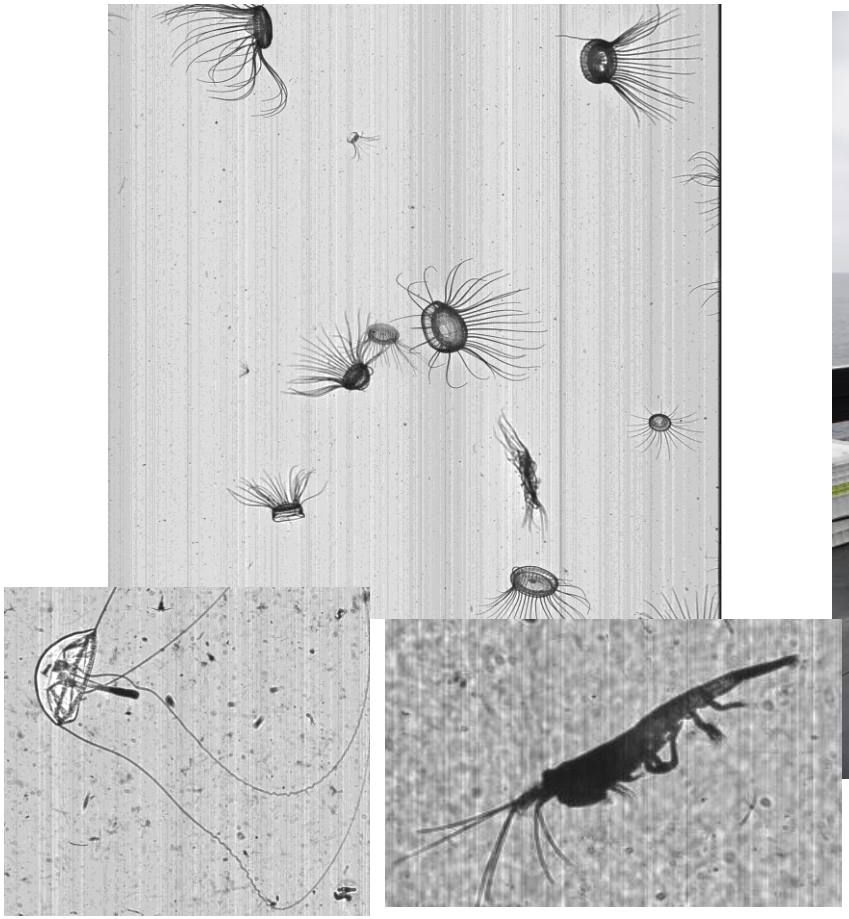
Underway Optical Plankton Sampling ISIIS



Quantitative high resolution imaging of larval fish and their predators in the upper 200 meters at a speed of 5 knots

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Advanced Survey Technologies
Southwest Fisheries Science Center

Underway Optical Fish Sampling

FasTowCam – Stereo Camera and environmental sampler

- Identifies acoustic scatterers
- Estimates fish sizes
- Environmental sampler (CTD + DO)
- Real-time display
- Tow speeds to 12 knots
- Tow depths to 500 m (nom. < 70 m)
- Developing automated detection and measuring software

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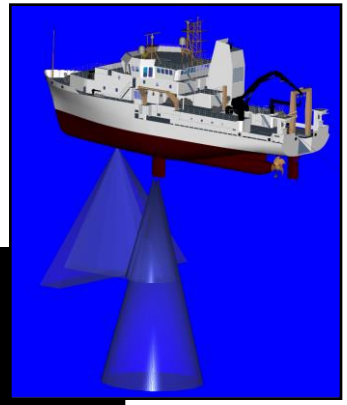
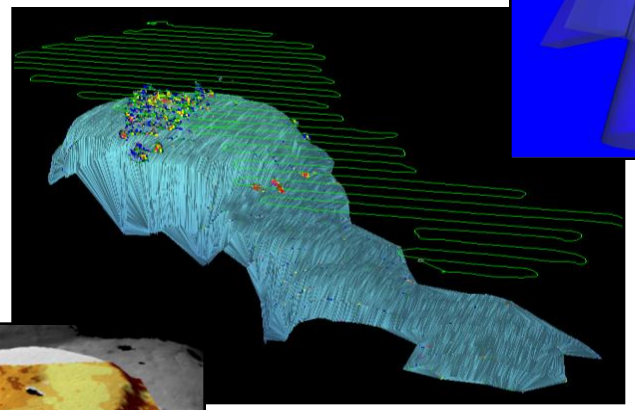
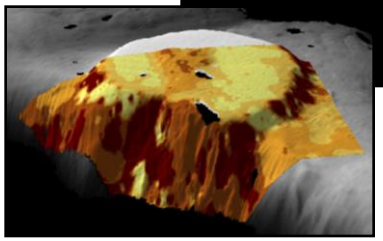
Underway Mapping of Fish and their Habitat



Multi-frequency echosounders (EK60s)

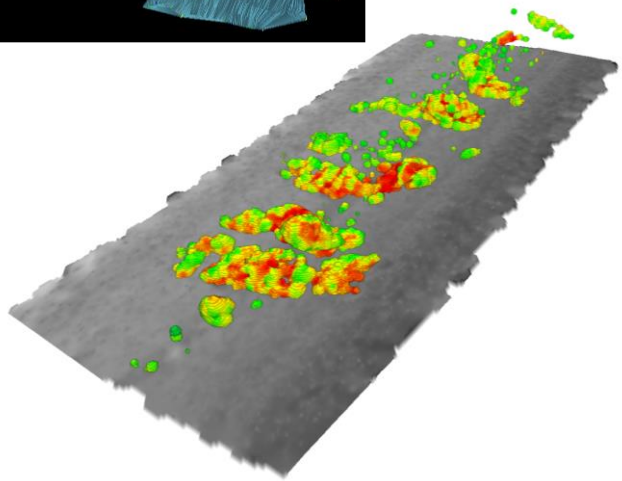
- Map biology and their seabed habitats
- Observe single fish and their behaviors





Multi-beam Echosounder (ME70)

- Map fish distributions
- Measure school sizes and shapes
- Observe fish behaviors



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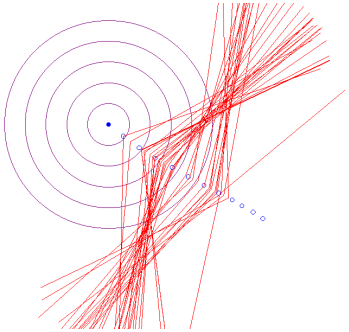
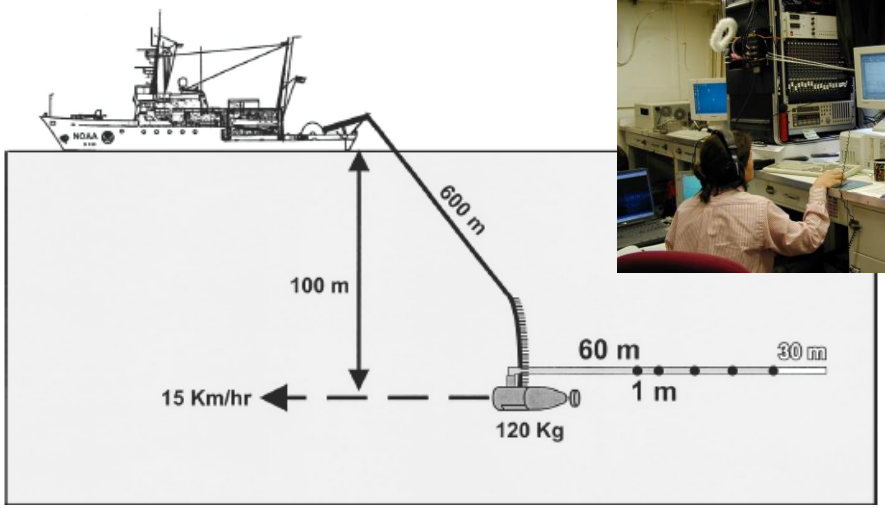
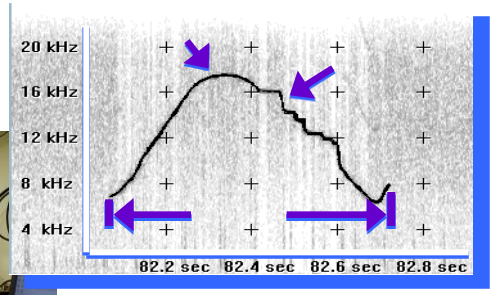
Passive Acoustics to Improve Marine Mammal Assessments

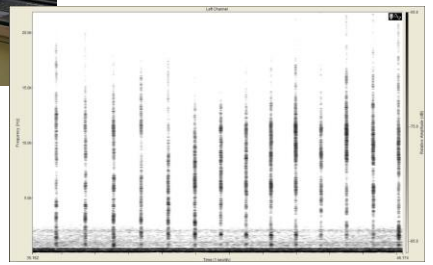
Underway towed hydrophone arrays allow for:

- Improved precision and reduced bias in abundance estimates (through estimation of fraction of schools not detected visually, particularly for deep-diving species)
- Determination of stock structure and DPS delineations (through identification of taxon-specific vocalizations)
- Development of methods to detect and identify cetaceans for mitigation of effects of anthropogenic perturbations (e.g. Navy, oil industry)









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Advanced Survey Technologies
Southwest Fisheries Science Center

Science and Technology-Development Tank

- State-of-the-art tank facility, unmatched world-wide
- 10 m deep x 10 m wide x 20 m long (2 M liters)
- Thermohaline controlled (2 - 23° C; fresh to seawater)
- Saves valuable ship-time
- Development and Testing
  - Sensors: multi-frequency, and multibeam echosounders
  - Autonomous platforms: tags, landers, buoys, floats, moored arrays, and AUVs
- Science experiments
  - Mammals, turtles, fish, and invertebrates
- Resource for partnerships